

COMPARISON OF THE PASSIVE STABILIZATION PROVIDED TO THE HUMAN CERVICAL SPINE BY THREE DIFFERENT CERVICAL BRACES

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Introduction

Cervical collars play an important role in stabilization of the cervical spine, both in emergent situations, as well as in long-term rehabilitative care (Alaranta, 1994).

Quantifying the support characteristics of each collar becomes imperative, then, in identifying the appropriate collar to use under given circumstances. Present biomechanical studies focus nearly exclusively upon identifying range of motion (ROM) for different collars using goniometers (Alaranta, 1994, Beavis, 1989) or radiological techniques (Fisher, 1977). However, range of motion (ROM) can be considered a subjective technique, as the range of motion may vary depending upon the amount of torque applied to the neck. In addition, the cervical spine needs to be supported within this range of motion, so flexibility becomes a significant objective measure of collar efficacy.

Methods

Ten healthy volunteers (5 male, 5 female), ranging in age from 21-60, with no history of cervical spine trauma or other disorders were selected for this study. The testing was performed in an unconstrained six-degree of freedom testing apparatus, using the methods of McClure (1998). Each subject was fitted and tested sequentially with three collars manufactured by the Philadelphia Collar

Company; the NecLoc[®], Flat-2-Piece[®], and the C-Loc[®], and then was tested without a collar, to serve as a control. The testing was performed passively by an operator, and motion in each direction (left and right lateral bending, flexion, extension, and left and right axial rotation) was repeated five times. The resulting ROM and flexibility data was then subjected to a repeated measures ANOVA (RMANOVA) test, followed by a Fisher's PLSD post-hoc test to determine statistical significance (P-value <0.05).

Results and Discussion

Lateral bending: All three cervical collars produced either statistically significant reduction in range of motion or statistically significant passive support (decreased flexibility). There were no statistically significant differences between the braces in these functions. However, the Flat-2-Piece collar provided the most reduction in ROM as well as the most passive support.

Flexion: All three collars produced statistically significant reduction in range of motion without providing statistically significant support to the cervical spine. The C-Loc brace provided the most ROM reduction as well as passive support, with no statistically significant passive stabilization differences between braces.

Extension: None of the braces limited range of motion in a statistically significant way or provided statistically significant passive support in this direction. However, the 2-Piece collar did provide the most ROM reduction as well as passive support.

Axial rotation: All cervical collars limited range of motion and provided passive support in a statistically significant way. There were no statistically significant differences between the braces, with the Flat-2-piece and NecLoc collars providing more passive stabilization than the C-Loc collar.

Summary

Many previous studies, examined only the limitation in range of motion provided by cervical collars (Lee, 1998, Lunsford, 1994), in this study, both the limitation in range of motion and the amount of passive support provided by the cervical collar were quantified. The study revealed that some cervical collars significantly limit range of motion and increase passive support to the cervical spine. However, there are significant differences between collars and it is therefore recommended that these

features be seriously considered by clinicians when prescribing cervical collars to their patients. This is particularly important when collars are used as a preventative measure, rather than as a “reminder” that the patient needs to protect their neck.

References

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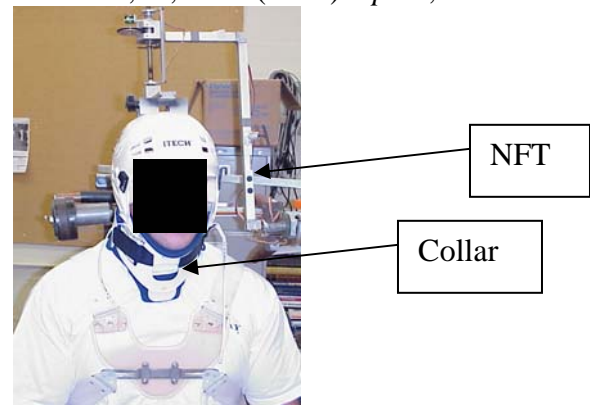


Figure 1: Photograph of a subject wearing a cervical collar and situated in the NFT.

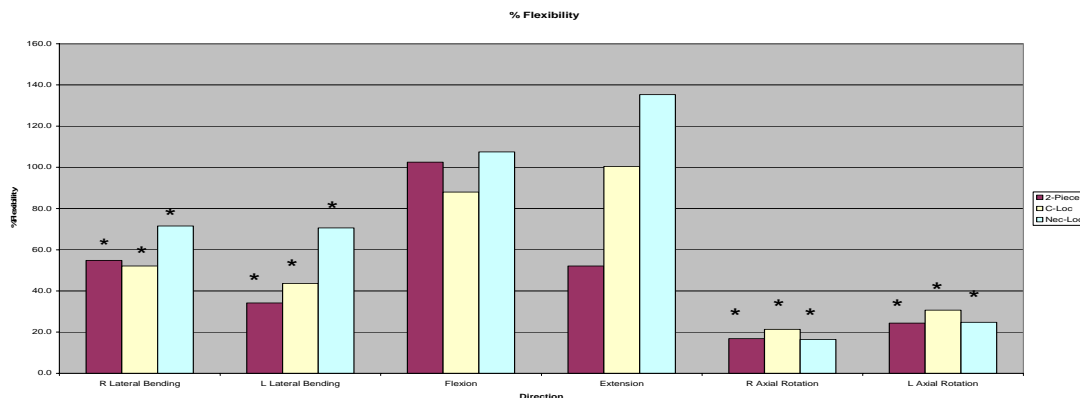


Figure 2 – Comparison between the braces in terms of percentage of unbraced flexibility (* indicates statistical significance)